CLAIMS

I/We claim:

1. A system for rendering chemical weapons materiel less hazardous, the system comprising a detonation chamber, an emission treater, and an expansion chamber in fluid communication with the detonation chamber and the emission treater, wherein the emission treater is adapted to treat gas from detonation of the chemical weapons materiel, yielding a substantially dry residual waste stream and a treated gas suitable for venting to atmosphere.

2. The system of claim 1 wherein the detonation chamber includes an inner chamber and an antechamber that can be sealed from the inner chamber, the antechamber including an air inlet and an air outlet configured to flush gas in the antechamber.

3. The system of claim 1 wherein the emission treater includes a conduit configured to introduce an alkaline powder into the gas being treated.

4. The system of claim 1 wherein the emission treater includes a solids reactor adapted to introduce an alkaline solid and a catalytic converter.

5. The system of claim 1 wherein the emission treater includes means for controllably cooling the gas from the detonation without introducing a liquid into the gas.

6. The system of claim 1 wherein the emission treater includes a reactive solids conduit and a heated gas conduit, wherein the reactive solids conduit is configured to introduce an alkaline powder into the gas being treated and the heated gas conduit is configured to deliver heated gas to

heat the gas in contact with the alkaline powder to a solids reaction temperature of at least about 600 °F.

7. The system of claim 6 wherein the heated gas conduit is configured to deliver heated gas to heat the gas in contact with the alkaline powder to the solids reaction temperature of no greater than about 1,200 °F

8. The system of claim 1 wherein the emission treater includes a conduit for delivering heated gas to the gas being treated.

9. The system of claim 1 wherein the system is of modular construction, with each module being sized for transport as an intermodal container.

10. The system of claim 1 wherein the system is of modular construction and includes first, second, third, and fourth modules, the first module comprising the detonation chamber, the second module comprising the expansion chamber, and the third and fourth modules comprising modular sections of the emission treater.

11. The system of claim 1 wherein the detonation chamber has an atmosphere comprising at least 25 weight percent oxygen and the system further comprises a detonation package in the detonation chamber, the detonation package including a container of the chemical weapons materiel and a charge of energetic material.

12. The system of claim 1 further comprising a pulse limiter disposed between the expansion chamber and the emission treater, the pulse limiter defining a communication opening having a first size during a first pressure phase and a second, larger size during a second pressure phase, the pressure in the first pressure phase being greater than the pressure in the second pressure phase.

13. The system of claim 1 further comprising means for heating an inner surface of the detonation chamber to a temperature of at least about 120 °F.

14. The system of claim 13 wherein the means for heating the inner surface comprises a heater that heats the expansion chamber.

15. The system of claim 1 further comprising first heating means for heating an inner surface of the detonation chamber to an operating temperature of about 120-300 °F and second heating means for heating the inner surface to a higher decontamination temperature for use in periodically decontaminating the detonation chamber.

16. The system of claim 13 wherein the first heating means comprises a heater that heats the expansion chamber.

17. The system of claim 1 further comprising a mechanical loader operatively associated with the detonation chamber and adapted to deliver the chemical weapons materiel to the detonation chamber.

18. A system for treating hazardous material, comprising:
a detonation chamber;
a gas treater;
a gas flow path between the detonation chamber and the gas treater; and
a pulse limiter disposed in the gas flow path, the pulse limiter defining a communication opening of varying size that limits gas flow along the gas flow path.

19. The system of claim 18 wherein the pulse limiter comprises a valve.

20. The system of claim 18 wherein the pulse limiter comprises a member having an orifice therethrough, the orifice having a size correlated to a pressure in the gas flow path downstream of the pulse limiter.

21. The system of claim 18 wherein the pulse limiter comprises a member having an orifice sized to limit flow of gas to the emission treatment to a predetermined maximum at an anticipated maximum pressure in the gas flow path upstream of the pulse limiter.

22. The system of claim 18 wherein the pulse limiter is adapted to change the size of the communication opening during a single detonation cycle.

23. The system of claim 18 wherein the pulse limiter is adapted to change the size of the communication opening as pressure upstream of the pulse limiter changes.

24. The system of claim 18 wherein the pulse limiter is adapted to change the size of the communication opening in response to a sensed pressure change.

25. A method of treating hazardous material, comprising:

explosively detonating a package comprising a hazardous material in a detonation chamber, wherein detonating the package generates a gas;

delivering the gas to a gas treater at a controlled flow rate, the flow rate being controlled with a pulse limiter that defines a communication opening having a restricted size correlated to a pressure pulse of the gas; and

changing the size of the communication opening.

26. The method of claim 25 wherein the size of the communication opening is varied during a single detonation cycle.

27. The method of claim 25 further comprising sensing pressure of the gas on an upstream side of the pulse limiter, wherein the size of the communication opening is changed in response to the sensed pressure.

28. The method of claim 25 further comprising determining a maximum anticipated pressure of the gas generated by the detonation and the restricted size of the opening is sized to limit a flow rate of the gas through the pulse limiter at the maximum anticipated pressure to a flow rate no greater than a predetermined maximum.

29. The method of claim 25 wherein detonating the package destroys at least about 98% of a hazardous chemical in the hazardous material.

30. The method of claim 25 wherein detonating the package destroys at least about 99% of a hazardous chemical in the hazardous material.

31. A method of treating hazardous materials, comprising:

explosively detonating a package comprising a hazardous material in a detonation chamber having an inner surface, wherein detonating the package generates a gas and at least a portion the inner surface is at a temperature of at least about 120 °F prior to detonating the package; and

delivering the gas to a gas treater.

32. The method of claim 31 wherein the portion of the inner surface is at a temperature of at least about 140 °F before detonating the package.

33. The method of claim 31 wherein the package is a first package and the hazardous material is a first hazardous material, the method further comprising, after delivering the gas to the gas treater, loading a second package comprising a second hazardous material in the detonation chamber and explosively detonating the second package, the portion of the inner surface being maintained at a temperature of at least about 140 °F between detonating the first package and detonating the second package.

34. The method of claim 31 further comprising loading the package in the detonation chamber, the temperature of the portion of the inner surface being at least about 120 °F when the package is loaded.

35. The method of claim 31 further comprising heating the detonation chamber prior to detonating the package to heat the portion of the inner surface to the temperature of at least about 120 °F.

36. The method of claim 31 further comprising delivering heated gas to the detonation chamber prior to detonating the package to heat the portion of the inner surface to the temperature of at least about 120 °F.

37. A system for treating hazardous materials comprising:

a detonation chamber configured to withstand repeated detonations of energetic material and having an interior surface;

a gas treater in fluid communication with the detonation chamber; and

a heater adapted to heat at least a portion of the interior surface of the detonation chamber between the detonations.

38. The system of claim 37 wherein the heater comprises a source of heated gas in fluid communication with an interior of the detonation chamber.

39. The system of claim 37 further comprising an expansion chamber disposed along a gas flow path between the detonation chamber and the gas treater, wherein the heater is coupled to the expansion chamber and indirectly heats the portion of the interior surface.

40. The system of claim 37 further comprising a mechanical loader operatively associated with the detonation chamber and adapted to deliver the energetic material to the detonation chamber.

41. A method of treating hazardous materials, comprising:

loading a first package comprising a first hazardous material in a detonation chamber having an inner surface;

explosively detonating the first package and generating a first gas;

delivering the first gas to a gas treater;

loading a second package comprising a second hazardous material in the detonation chamber;

explosively detonating the second package and generating a second gas;

delivering the second gas to the gas treater; and

maintaining at least a portion the inner surface at a temperature of at least about 120 °F between detonating the first package and detonating the second package.

42. The method of claim 41 wherein the portion of the inner surface is maintained at a temperature of at least about 140 °F between the detonating the first package and detonating the second package.

43. The method of claim 41 wherein maintaining the portion of the inner surface at the temperature of at least about 120 °F comprises applying heat from a heating means to the portion of the inner surface.

44. The method of claim 41 wherein maintaining the portion of the inner surface at the temperature of at least about 120 °F comprises delivering heated gas to the detonation chamber.

45. A method of treating hazardous materials, comprising:

explosively detonating a package comprising a hazardous material in a detonation chamber, wherein detonating the package generates a gas;

delivering the gas to an expansion chamber;

delivering the gas from the expansion chamber to a reaction zone and contacting the gas with a reactant in the reaction zone to interact with components of the gas, interaction of the reactant and the components of the gas producing a byproduct; and

removing particulate matter from the gas, the particulate matter including the byproduct;

delivering the gas to a catalytic converter after removing the particulate matter.

46. A system for treating hazardous materials comprising:

a detonation chamber;

an expansion chamber in fluid communication with the detonation chamber to receive gas generated by a detonation in the detonation chamber; and

a gas treatment system in fluid communication with the expansion chamber to receive the gas from the expansion chamber, the air treatment system comprising:

a gas conduit and a reactant supply in communication with the gas conduit, a reactant from the reactant supply interacting with the gas from the expansion chamber to form a byproduct;

a filter positioned downstream of the reactant supply and adapted to filter at least a portion of the byproduct from the gas; and

a catalytic converter positioned downstream of the filter and adapted to treat the filtered gas.

47. The system of claim 46 wherein the reactant in the reactant supply comprises an alkaline powder.